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# Marsh Lake
# Steuben County, Indiana

Pacific Northwest Environmental Res. Lab.

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March 1976

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# U.S. ENVIRONMENTAL PROTECTION AGENCY
# NATIONAL EUTROPHICATION SURVEY

## WORKING PAPER SERIES

**CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON**

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# REPORT
# ON
# MARSH LAKE
# STEUBEN COUNTY
# INDIANA
# EPA REGION V
# WORKING PAPER No. 333

WITH THE COOPERATION OF THE
INDIANA STATE BOARD OF HEALTH
AND THE
INDIANA NATIONAL GUARD
MARCH, 1976

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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|---|---|---|
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# F O R E W O R D

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

## OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

## ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

## LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning {§303(e)}, water quality criteria/standards review {§303(c)}, clean lakes {§314(a,b)}, and water quality monitoring {§106 and §305(b)} activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Indiana State Board of Health for professional involvement, to the Indiana National Guard for conducting the tributary sampling phase of the Survey, and to those Indiana wastewater treatment plant operators who provided effluent samples and flow data.

The staff of the Division of Water Pollution Control, Indiana State Board of Health, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

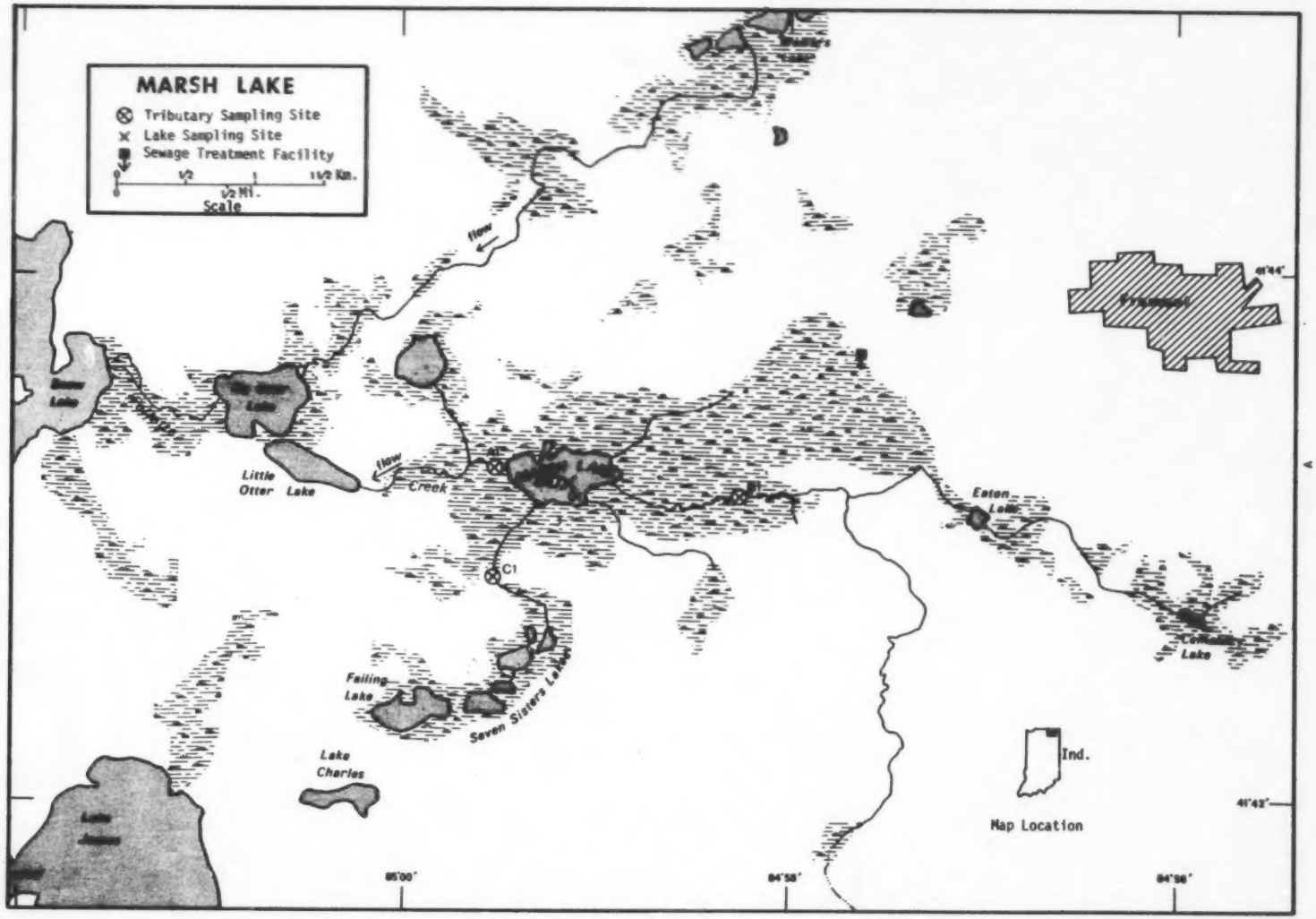
Major General Alfred F. Ahner, Adjutant General of Indiana, and Project Officers Lt. Colonel Charles B. Roberts (Retired) and Colonel Robert L. Sharp, who directed the volunteer efforts of the Indiana National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF INDIANA

| LAKE NAME | COUNTY |
|---|---|
| Bass | Starke |
| Cataract | Owen, Putnam |
| Crooked | Steuben |
| Dallas | LaGrange |
| Geist | Hamilton, Marion |
| Hamilton | Steuben |
| Hovey | Posey |
| James | Kosciusko |
| James | Steuben |
| Long | Steuben |
| Marsh | Steuben |
| Mississinewa | Grant, Miami, Wabash |
| Maxinkuckee | Marshall |
| Monroe | Brown, Monroe |
| Morse | Hamilton |
| Olin | LaGrange |
| Oliver | LaGrange |
| Pigeon | Steuben |
| Sylvan | Noble |
| Tippecanoe | Kosciusko |
| Versailles | Ripley |
| Wawassee | Kosciusko |
| Webster | Kosciusko |
| Westler | LaGrange |
| Whitewater | Union |
| Winona | Kosciusko |
| Witmer | LaGrange |


MARSH LAKE
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
½ 1 1½ Km.
½ MI.
Scale
Flow
Little Otter Lake
Flow
Creek
C1
Eaton Lake
Failing Lake
Seven Sisters Lakes
Lake Charles
Ind.
Map Location
85°00'
84°58'
84°56'
41°43'

MARSH LAKE

STORET NO. 1856

# I. CONCLUSIONS

## A. Trophic Condition:

Survey data indicate that Marsh Lake is eutrophic. It ranked 21st in overall trophic quality when the 27 Indiana lakes sampled in 1973 were compared using a combination of six parameters*. Twenty-two of the lakes had less median total phosphorus, 25 had less median dissolved phosphorus, seven had less median inorganic nitrogen, 22 had less mean chlorophyll a, and 17 had greater mean Secchi disc transparency. Dissolved oxygen was depleted in the hypolimnion in August and October.

Survey limnologists reported emergent macrophytes in the shoreline shallows around the lake and the island.

## B. Rate-Limiting Nutrient:

Because of a significant loss of nutrients in the sample before the algal assay was begun, the results are not representative of conditions in the lake at the time the sample was taken (05/03/73).

The lake data indicate nitrogen limitation at all sampling times.

## C. Nutrient Controllability:

1. Point sources--During the sampling year, Marsh Lake

* See Appendix A.

received a total phosphorus loading more than four times that proposed by Vollenweider (Vollenweider and Dillon, 1974) as a eutrophic loading (see page 12). The Village of Fremont contributed 80% of that load.

It is calculated that removal of 97% of the phosphorus at the Fremont wastewater treatment plant would reduce the phosphorus loading to just equal the eutrophic loading. Short of effluent diversion, it is questionable whether removal at that level can be accomplished on a continuing basis. However, a high degree of phosphorus removal at the point source is likely to result in persistent phosphorus limitation in Marsh Lake and should at least reduce the incidence and severity of nuisance algal blooms.

2. Non-point sources--The non-point source phosphorus load was estimated to be 20% of the total. The gaged tributaries were estimated to have contributed 13.6% of the total, and the ungaged tributaries were estimated to have contributed 6.1%.

The phosphorus export rate of Unnamed Creek C-1 (7 $kg/km^2/yr$) was quite low as compared to Indiana streams sampled elsewhere (see page 11).

## II. LAKE AND DRAINAGE BASIN CHARACTERISTICS†

### A. Lake Morphometry††:

1. Surface area: 0.23 kilometers$^2$.
2. Mean depth: 6.1 meters.
3. Maximum depth: 11.6 meters.
4. Volume: $1.403 \times 10^6$ m$^3$.
5. Mean hydraulic retention time: 45 days.

### B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

| Name | Drainage area (km$^2$)* | Mean flow (m$^3$/sec)* |
|---|---|---|
| Unnamed Creek B-1 | 21.0 | 0.20 |
| Unnamed Creek C-1 | 5.4 | 0.05 |
| Minor tributaries & immediate drainage - | 12.0 | 0.11 |
| Total | 38.4 | 0.36 |

2. Outlet -

| | | |
|---|---|---|
| Follett Creek | 38.6** | 0.36 |

### C. Precipitation***:

1. Year of sampling: 111.6 centimeters.
2. Mean annual: 91.3 centimeters.

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† Table of metric conversions--Appendix B.
†† Winters, 1973.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

## III. LAKE WATER QUALITY SUMMARY

Marsh Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from a number of depths at a single station on the lake (see map, page v). During each visit, a single depth-integrated (4.6 m to surface) sample was collected for phytoplankton identification and enumeration, and a similar sample was taken for chlorophyll a analysis. During the first visit, a single 18.9-liter depth-integrated sample was collected for algal assays. The maximum depth sampled was 10.7 meters.

The sampling results are presented in full in Appendix D and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR MARSH LAKE
STORET CODE 1856

| PARAMETER | 1ST SAMPLING ( 5/ 3/73) 1 SITES RANGE | MEAN | MEDIAN | 2ND SAMPLING ( 8/ 6/73) 1 SITES RANGE | MEAN | MEDIAN | 3RD SAMPLING (10/15/73) 1 SITES RANGE | MEAN | MEDIAN |
|---|---|---|---|---|---|---|---|---|---|
| TEMP (C) | 8.7 - 12.7 | 11.4 | 12.7 | 10.1 - 25.4 | 16.2 | 13.5 | 8.9 - 16.7 | 13.1 | 13.4 |
| DISS OXY (MG/L) | 5.2 - 10.0 | 8.5 | 9.4 | 0.0 - 18.0 | 7.0 | 2.8 | 0.0 - 9.4 | 3.1 | 1.5 |
| CNDCTVY (MCROMO) | 625. - 650. | 643. | 650. | 470. - 611. | 525. | 489. | 497. - 557. | 527. | 527. |
| PH (STAND UNITS) | 8.0 - 8.4 | 8.3 | 8.3 | 7.4 - 8.6 | 8.0 | 7.9 | 7.1 - 8.4 | 7.7 | 7.7 |
| TOT ALK (MG/L) | 210. - 250. | 233. | 230. | 250. - 420. | 304. | 276. | 270. - 355. | 307. | 301. |
| TOT P (MG/L) | 0.045 - 0.215 | 0.084 | 0.053 | 0.078 - 1.480 | 0.388 | 0.101 | 0.053 - 0.888 | 0.305 | 0.180 |
| ORTHO P (MG/L) | 0.009 - 0.194 | 0.053 | 0.019 | 0.019 - 1.380 | 0.324 | 0.066 | 0.009 - 0.688 | 0.236 | 0.123 |
| NO2+NO3 (MG/L) | 0.060 - 0.310 | 0.142 | 0.070 | 0.070 - 0.240 | 0.106 | 0.070 | 0.070 - 0.110 | 0.087 | 0.085 |
| AMMONIA (MG/L) | 0.060 - 0.620 | 0.198 | 0.080 | 0.070 - 3.900 | 0.894 | 0.090 | 0.080 - 7.680 | 2.595 | 1.310 |
| KJEL N (MG/L) | 1.000 - 1.400 | 1.120 | 1.100 | 0.900 - 5.500 | 2.020 | 1.200 | 1.080 -10.100 | 3.850 | 2.150 |
| INORG N (MG/L) | 0.120 - 0.930 | 0.340 | 0.150 | 0.140 - 4.140 | 1.000 | 0.170 | 0.150 - 7.770 | 2.682 | 1.405 |
| TOTAL N (MG/L) | 1.060 - 1.710 | 1.262 | 1.170 | 0.980 - 5.740 | 2.126 | 1.270 | 1.070 -10.190 | 3.937 | 2.245 |
| CHLRPYL A (UG/L) | 33.4 - 33.4 | 33.4 | 33.4 | 19.4 - 19.4 | 19.4 | 19.4 | 50.6 - 50.6 | 50.6 | 50.6 |
| SECCHI (METERS) | 1.2 - 1.2 | 1.2 | 1.2 | 1.3 - 1.3 | 1.3 | 1.3 | 1.2 - 1.2 | 1.2 | 1.2 |

B. Biological characteristics:

1. Phytoplankton -

| Sampling Date | Dominant Genera | Algal Units per ml |
|---|---|---|
| 05/03/73 | 1. Dinobryon sp. | 19,189 |
| | 2. Flagellates | 5,586 |
| | 3. Cryptomonas sp. | 811 |
| | 4. Cyclotella sp. | 450 |
| | 5. Raphidiopsis sp. | 360 |
| | Other genera | 541 |
| | Total | 26,937 |
| 08/06/73 | 1. Gloeocystis sp. | 124 |
| | 2. Oscillatoria sp. | 74 |
| | 3. Melosira sp. | 74 |
| | 4. Anabaena sp. | 50 |
| | 5. Microcystis sp. | 25 |
| | Other genera | 50 |
| | Total | 397 |
| 10/15/73 | 1. Fragilaria sp. | 9,824 |
| | 2. Aphanizomenon sp. | 1,027 |
| | 3. Cryptomonas sp. | 469 |
| | 4. Oscillatoria sp. | 67 |
| | 5. Anabaena sp. | 22 |
| | Other genera | 66 |
| | Total | 11,475 |

2. Chlorophyll a -

| Sampling Date | Station Number | Chlorophyll a (µg/l) |
|---|---|---|
| 05/03/73 | 1 | 33.4 |
| 08/06/73 | 1 | 19.4 |
| 10/15/73 | 1 | 50.6 |

C. Limiting Nutrient Study:

There was a 62% loss of orthophosphorus in the assay sample from the time of collection to the beginning of the assay, and the results are not representative of conditions in the lake at the time the sample was taken (05/03/73).

The lake data indicate nitrogen limitation; i.e., the mean inorganic nitrogen/orthophosphorus ratios were 11/1 or less at all sampling times, and nitrogen limitation would be expected.

Nitrogen limitation, as indicated by in-lake nitrogen to phosphorus ratios, does not necessarily mean that the trophic condition of the lake can be improved by controlling nitrogen inputs. In many cases, the apparent condition of nitrogen-limitation results from excessive phosphorus input from point sources and is often accompanied by a corresponding increase in primary production. In such cases, the reversal of the enriched condition depends upon phosphorus control, not nitrogen control.

## IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Indiana National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of February and March when two samples were collected. Sampling was begun in June, 1973, and was completed in May, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Indiana District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

Except for phosphorus in Unnamed Creek B-1, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. The phosphorus load measured in Unnamed Creek B-1 was less than the Fremont wastewater treatment plant load, and the background phosphorus load of this stream was estimated in the same way as the "ZZ" load (see below). However, note that the nitrogen load given for this stream is that measured at B-1 minus the Fremont load.

Nutrient loads for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the nutrient loads, in $kg/km^2/year$, at station C-1 and multiplying by the ZZ area in $km^2$.

* See Working Paper No. 175.

The operator of the Fremont wastewater treatment plant provided monthly effluent samples and corresponding flow data.

A. Waste Sources:

1. Known municipal* -

| Name | Pop. Served | Treatment | Mean Flow ($m^3/d$) | Receiving Water |
|---|---|---|---|---|
| Fremont | 1,043** | tr. filter | 541.7 | Unnamed Creek B-1 |

2. Known industrial - None

* Anonymous, 1971.
** 1970 Census.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

| Source | kg P/ yr | % of total |
|---|---|---|
| a. Tributaries (non-point load) - | | |
| Unnamed Creek B-1 | 150 | 10.7 |
| Unnamed Creek C-1 | 40 | 2.8 |
| b. Minor tributaries & immediate drainage (non-point load) - | 85 | 6.1 |
| c. Known municipal STP's - | | |
| Fremont | 1,120 | 80.0 |
| d. Septic tanks - Unknown | - | - |
| e. Known industrial - None | - | - |
| f. Direct precipitation* - | 5 | 0.4 |
| Total | 1,400 | 100.0 |

2. Outputs -

Lake outlet - Follett Creek 1,310

3. Net annual P accumulation - 90 kg.

* See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

| Source | kg N/yr | % of total |
|---|---|---|
| a. Tributaries (non-point load) - | | |
| Unnamed Creek B-1 | 9,560 | 49.7 |
| Unnamed Creek C-1 | 1,570 | 8.2 |
| b. Minor tributaries & immediate drainage (non-point load) - | 3,490 | 18.1 |
| c. Known municipal STP's - | | |
| Fremont | 4,380 | 22.8 |
| d. Septic tanks - Unknown | - | - |
| e. Known industrial - None | - | - |
| f. Direct precipitation* - | 250 | 1.2 |
| Total | 19,250 | 100.0 |

2. Outputs -

| | |
|---|---|
| Lake outlet - Follett Creek | 19,705 |

3. Net annual N loss - 455 kg.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

| Tributary | kg P/km$^2$/yr | kg N/km$^2$/yr |
|---|---|---|
| Unnamed Creek B-1 | - | 455 |
| Unnamed Creek C-1 | 7 | 291 |

* See Working Paper No. 175.

E. Yearly Loads:

In the following table, the existing phosphorus loadings are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" loading is one at which the receiving water would become eutrophic or remain eutrophic; his "permissible" loading is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic loading would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

| | Total Phosphorus | | Total Nitrogen | |
|---|---|---|---|---|
| | Total | Accumulated | Total | Accumulated |
| grams/$m^2$/yr | 6.09 | 0.39 | 83.7 | loss* |

| Vollenweider phosphorus loadings ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Marsh Lake: | |
|---|---|
| "Dangerous" (eutrophic loading) | 1.34 |
| "Permissible" (oligotrophic loading) | 0.67 |

* There was an apparent loss of nitrogen during the sampling year. This may have been due to nitrogen fixation in the lake, solubilization of previously sedimented nitrogen, recharge with nitrogen-rich ground water, unknown and unsampled point sources discharging directly to the lake, or insufficient outlet sampling in relation to the relatively short hydraulic retention time of the lake. Whatever the cause, a similar nitrogen loss has occurred at Shagawa Lake, Minnesota, which has been intensively studied by EPA's former National Eutrophication and Lake Restoration Branch (Malueg et al., 1975).

## V. LITERATURE REVIEWED

Anonymous, 1971. Inventory of municipal waste facilities. EPA Publ. WP-1, vol. 5, Washington, DC.

Malueg, Kenneth W., D. Phillips Larsen, Donald W. Schults, and Howard T. Mercier; 1975. A six-year water, phosphorus, and nitrogen budget for Shagawa Lake, Minnesota. Jour. Environ. Qual., vol. 4, no. 2, pp. 236-242.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

Winters, John, 1975. Personal communication (lake morphometry). IN Div. of Water Poll. Contr., Indianapolis.

# VI. APPENDICES

## APPENDIX A

## LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

| LAKE CODE | LAKE NAME | MEDIAN TOTAL P | MEDIAN INORG N | 500-MEAN SEC | MEAN CHLORA | 15-MIN DO | MEDIAN DISS ORTHO P |
|---|---|---|---|---|---|---|---|
| 1805 | CATAHACT LAKE | 0.058 | 1.660 | 466.667 | 10.744 | 15.000 | 0.013 |
| 1811 | GEIST RESERVOIR | 0.074 | 1.080 | 472.500 | 45.950 | 11.600 | 0.009 |
| 1817 | JAMES LAKE | 0.024 | 1.030 | 434.000 | 11.533 | 15.000 | 0.008 |
| 1827 | MISSISSINEWA RESERVOIR | 0.107 | 2.400 | 473.444 | 15.778 | 15.000 | 0.029 |
| 1826 | MONROE RESERVOIR | 0.025 | 0.325 | 438.823 | 6.947 | 15.000 | 0.007 |
| 1829 | MORSE RESERVOIR | 0.084 | 3.325 | 473.222 | 56.167 | 15.000 | 0.009 |
| 1836 | WAWASEE LAKE | 0.012 | 0.210 | 364.500 | 5.000 | 14.600 | 0.003 |
| 1837 | WEBSTER LAKE | 0.025 | 0.790 | 431.000 | 11.500 | 15.000 | 0.005 |
| 1839 | WHITEWATER LAKE | 0.084 | 1.620 | 470.167 | 33.083 | 15.000 | 0.012 |
| 1840 | WINONA LAKE | 0.035 | 1.250 | 444.667 | 11.211 | 15.000 | 0.011 |
| 1841 | WESTLER LAKE | 0.035 | 0.860 | 427.125 | 10.712 | 15.000 | 0.013 |
| 1842 | WITMER LAKE | 0.035 | 0.900 | 440.333 | 11.917 | 15.000 | 0.011 |
| 1843 | LAKE MAXINKUCKEE | 0.020 | 0.220 | 400.400 | 5.483 | 15.000 | 0.003 |
| 1844 | TIPPECANOE LAKE | 0.019 | 0.195 | 391.500 | 6.050 | 15.000 | 0.005 |
| 1845 | DALLAS LAKE | 0.029 | 0.830 | 413.333 | 10.067 | 15.000 | 0.014 |
| 1846 | OLIN LAKE | 0.012 | 1.460 | 403.333 | 4.867 | 14.900 | 0.003 |
| 1847 | OLIVER LAKE | 0.009 | 0.920 | 392.000 | 3.767 | 14.800 | 0.004 |
| 1848 | SYLVAN LAKE | 0.170 | 0.130 | 469.833 | 47.480 | 14.800 | 0.017 |
| 1849 | HOVEY LAKE | 0.062 | 1.050 | 489.333 | 84.267 | 7.600 | 0.024 |
| 1850 | VERSAILLES LAKE | 0.139 | 1.090 | 482.000 | 25.078 | 14.500 | 0.019 |
| 1851 | BASS LAKE | 0.040 | 0.250 | 471.375 | 29.367 | 7.000 | 3.012 |
| 1852 | CROOKED LAKE | 0.019 | 0.120 | 410.111 | 5.578 | 15.000 | 0.005 |
| 1853 | LAKE JAMES | 0.016 | 0.190 | 352.444 | 4.856 | 15.000 | 0.005 |
| 1854 | LONG LAKE | 0.204 | 1.920 | 442.667 | 16.100 | 15.000 | 0.150 |
| 1855 | PIGEON LAKE | 0.058 | 1.945 | 442.667 | 11.900 | 15.000 | 0.015 |
| 1856 | MARSH LAKE | 0.093 | 0.270 | 451.333 | 34.467 | 15.000 | 0.055 |
| 1857 | HAMILTON LAKE | 0.033 | 0.720 | 413.167 | 17.450 | 15.000 | 0.018 |

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

| LAKE CODE | LAKE NAME | MEDIAN TOTAL P | MEDIAN INORG N | 500-MEAN SEC | MEAN CHLORA | 15-MIN DO | MEDIAN DISS ORTHO P | INDEX NO |
|---|---|---|---|---|---|---|---|---|
| 1805 | CATARACT LAKE | 37 ( 9) | 15 ( 4) | 31 ( 8) | 62 ( 16) | 35 ( 0) | 37 ( 9) | 217 |
| 1811 | GEIST RESERVOIR | 27 ( 7) | 35 ( 9) | 15 ( 4) | 12 ( 3) | 92 ( 24) | 62 ( 16) | 243 |
| 1817 | JAMES LAKE | 73 ( 19) | 42 ( 11) | 58 ( 15) | 50 ( 13) | 35 ( 0) | 65 ( 17) | 323 |
| 1827 | MISSISSINEWA RESERVOIR | 12 ( 3) | 4 ( 1) | 8 ( 2) | 38 ( 10) | 35 ( 0) | 8 ( 2) | 105 |
| 1828 | MONROE RESERVOIR | 67 ( 17) | 69 ( 18) | 54 ( 14) | 73 ( 19) | 35 ( 0) | 69 ( 18) | 367 |
| 1829 | MORSE RESERVOIR | 23 ( 6) | 0 ( 0) | 12 ( 3) | 4 ( 1) | 35 ( 0) | 58 ( 15) | 132 |
| 1836 | WAWASEE LAKE | 94 ( 24) | 85 ( 22) | 96 ( 25) | 88 ( 23) | 85 ( 22) | 98 ( 25) | 546 |
| 1837 | WEBSTER LAKE | 67 ( 17) | 62 ( 16) | 62 ( 16) | 54 ( 14) | 35 ( 0) | 81 ( 21) | 361 |
| 1839 | WHITEWATER LAKE | 19 ( 5) | 19 ( 5) | 23 ( 6) | 19 ( 5) | 35 ( 0) | 42 ( 11) | 157 |
| 1840 | WINONA LAKE | 50 ( 12) | 27 ( 7) | 38 ( 10) | 58 ( 15) | 35 ( 0) | 52 ( 13) | 260 |
| 1841 | WESTLER LAKE | 50 ( 12) | 54 ( 14) | 65 ( 17) | 65 ( 17) | 35 ( 0) | 37 ( 9) | 306 |
| 1842 | WITMER LAKE | 50 ( 12) | 50 ( 13) | 50 ( 13) | 42 ( 11) | 35 ( 0) | 52 ( 13) | 279 |
| 1843 | LAKE MAXINKUCKEE | 77 ( 20) | 81 ( 21) | 85 ( 22) | 85 ( 22) | 35 ( 0) | 98 ( 25) | 461 |
| 1844 | TIPPECANOE LAKE | 85 ( 22) | 88 ( 23) | 92 ( 24) | 77 ( 20) | 35 ( 0) | 85 ( 22) | 462 |
| 1845 | DALLAS LAKE | 62 ( 16) | 58 ( 15) | 69 ( 18) | 69 ( 18) | 35 ( 0) | 31 ( 8) | 324 |
| 1846 | OLIN LAKE | 94 ( 24) | 23 ( 6) | 81 ( 21) | 92 ( 24) | 73 ( 19) | 92 ( 24) | 455 |
| 1847 | OLIVER LAKE | 100 ( 26) | 46 ( 12) | 88 ( 23) | 100 ( 26) | 79 ( 20) | 88 ( 23) | 501 |
| 1848 | SYLVAN LAKE | 4 ( 1) | 96 ( 25) | 27 ( 7) | 8 ( 2) | 79 ( 20) | 23 ( 6) | 237 |
| 1849 | HOVEY LAKE | 31 ( 8) | 38 ( 10) | 0 ( 0) | 0 ( 0) | 96 ( 25) | 12 ( 3) | 177 |
| 1850 | VERSAILLES LAKE | 8 ( 2) | 31 ( 8) | 4 ( 1) | 27 ( 7) | 88 ( 23) | 15 ( 4) | 173 |
| 1851 | BASS LAKE | 42 ( 11) | 77 ( 20) | 19 ( 5) | 23 ( 6) | 100 ( 26) | 46 ( 12) | 307 |
| 1852 | CROOKED LAKE | 81 ( 21) | 100 ( 26) | 77 ( 20) | 81 ( 21) | 35 ( 0) | 75 ( 19) | 449 |
| 1853 | LAKE JAMES | 88 ( 23) | 92 ( 24) | 100 ( 26) | 96 ( 25) | 35 ( 0) | 75 ( 19) | 486 |
| 1854 | LONG LAKE | 0 ( 0) | 12 ( 3) | 44 ( 11) | 35 ( 9) | 35 ( 0) | 0 ( 0) | 126 |
| 1855 | PIGEON LAKE | 37 ( 9) | 8 ( 2) | 44 ( 11) | 46 ( 12) | 35 ( 0) | 27 ( 7) | 197 |
| 1856 | MARSH LAKE | 15 ( 4) | 73 ( 19) | 35 ( 9) | 15 ( 4) | 35 ( 0) | 4 ( 1) | 177 |
| 1857 | HAMILTON LAKE | 58 ( 15) | 65 ( 17) | 73 ( 19) | 31 ( 8) | 35 ( 0) | 19 ( 5) | 281 |

LAKES RANKED BY INDEX NOS.

| RANK | LAKE CODE | LAKE NAME | INDEX NO |
|---|---|---|---|
| 1 | 1836 | WAWASEE LAKE | 546 |
| 2 | 1847 | OLIVER LAKE | 501 |
| 3 | 1853 | LAKE JAMES | 486 |
| 4 | 1844 | TIPPECANOE LAKE | 462 |
| 5 | 1843 | LAKE MAXINKUCKEE | 461 |
| 6 | 1846 | OLIN LAKE | 455 |
| 7 | 1852 | CROOKED LAKE | 449 |
| 8 | 1828 | MONROE RESERVOIR | 367 |
| 9 | 1837 | WEBSTER LAKE | 361 |
| 10 | 1845 | DALLAS LAKE | 324 |
| 11 | 1817 | JAMES LAKE | 323 |
| 12 | 1851 | BASS LAKE | 307 |
| 13 | 1841 | WESTLER LAKE | 306 |
| 14 | 1857 | HAMILTON LAKE | 281 |
| 15 | 1842 | WITMER LAKE | 279 |
| 16 | 1840 | WINONA LAKE | 260 |
| 17 | 1811 | GEIST RESERVOIR | 243 |
| 18 | 1848 | SYLVAN LAKE | 237 |
| 19 | 1885 | CATARACT LAKE | 217 |
| 20 | 1855 | PIGEON LAKE | 197 |
| 21 | 1856 | MARSH LAKE | 177 |
| 22 | 1849 | HOVEY LAKE | 177 |
| 23 | 1850 | VERSAILLES LAKE | 173 |
| 24 | 1839 | WHITEWATER LAKE | 157 |
| 25 | 1829 | MORSE RESERVOIR | 132 |
| 26 | 1854 | LONG LAKE | 126 |
| 27 | 1827 | MISSISSINEWA RESERVOIR | 105 |

# APPENDIX B

## CONVERSION FACTORS

## CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x $8.107 \times 10^{-4}$ = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

# APPENDIX C

## TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR INDIANA 03/29/76

LAKE CODE 1856 MARSH LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 38.6

| TRIBUTARY | SUB-DRAINAGE AREA(SQ KM) | NORMALIZED FLOWS(CMS) JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC | MEAN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1856A1 | 38.6 | 0.459 | 0.552 | 0.790 | 0.736 | 0.473 | 0.362 | 0.218 | 0.074 | 0.071 | 0.074 | 0.190 | 0.351 | 0.361 |
| 1856B1 | 21.0 | 0.244 | 0.300 | 0.433 | 0.402 | 0.258 | 0.198 | 0.116 | 0.037 | 0.037 | 0.037 | 0.102 | 0.193 | 0.196 |
| 1856C1 | 5.4 | 0.059 | 0.076 | 0.113 | 0.105 | 0.065 | 0.051 | 0.031 | 0.008 | 0.008 | 0.009 | 0.026 | 0.051 | 0.050 |
| 1856ZZ | 12.2 | 0.139 | 0.173 | 0.252 | 0.232 | 0.147 | 0.116 | 0.068 | 0.020 | 0.021 | 0.021 | 0.059 | 0.113 | 0.113 |

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 38.6
SUM OF SUB-DRAINAGE AREAS = 38.6

TOTAL FLOW IN = 4.32
TOTAL FLOW OUT = 4.35

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 1856A1 | 6 | 73 | 0.646 | 9 | 0.595 | | | | |
| | 7 | 73 | 0.708 | 15 | 0.340 | | | | |
| | 8 | 73 | 0.292 | 12 | 0.272 | | | | |
| | 9 | 73 | 0.130 | 17 | 0.153 | | | | |
| | 10 | 73 | 0.092 | 15 | 0.144 | | | | |
| | 11 | 73 | 0.107 | 11 | 0.079 | | | | |
| | 12 | 73 | 0.240 | 8 | 0.227 | | | | |
| | 1 | 74 | 1.107 | 6 | 0.280 | | | | |
| | 2 | 74 | 0.765 | 10 | 0.481 | 24 | 0.566 | | |
| | 3 | 74 | 0.657 | 10 | 0.566 | 26 | 0.340 | | |
| | 4 | 74 | 0.504 | 9 | 0.481 | | | | |
| | 5 | 74 | 0.555 | 5 | 0.215 | | | | |
| 1856B1 | 6 | 73 | 0.351 | 9 | 0.246 | | | | |
| | 7 | 73 | 0.385 | 15 | 0.099 | | | | |
| | 8 | 73 | 0.158 | 12 | 0.133 | | | | |
| | 9 | 73 | 0.071 | 17 | 0.091 | | | | |
| | 10 | 73 | 0.051 | 15 | 0.085 | | | | |
| | 11 | 73 | 0.058 | 11 | 0.062 | | | | |
| | 12 | 73 | 0.131 | 8 | 0.122 | | | | |
| | 1 | 74 | 0.603 | 6 | 0.147 | | | | |
| | 2 | 74 | 0.416 | 10 | 0.207 | 24 | 0.238 | | |
| | 3 | 74 | 0.357 | 10 | 0.235 | 26 | 0.161 | | |
| | 4 | 74 | 0.274 | 9 | 0.215 | | | | |
| | 5 | 74 | 0.303 | 5 | 0.125 | | | | |

TRIBUTARY FLOW INFORMATION FOR INDIANA 03/29/76

LAKE CODE 1856 MARSH LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

| TRIBUTARY | MONTH | YEAR | MEAN FLOW | DAY | FLOW | DAY | FLOW | DAY | FLOW |
|---|---|---|---|---|---|---|---|---|---|
| 1856C1 | 6 | 73 | 0.091 | 9 | 0.068 | | | | |
| | 7 | 73 | 0.100 | 15 | 0.020 | | | | |
| | 8 | 73 | 0.041 | 12 | 0.011 | | | | |
| | 9 | 73 | 0.018 | 17 | 0.003 | | | | |
| | 10 | 73 | 0.013 | 15 | 0.003 | | | | |
| | 11 | 73 | 0.015 | 11 | 0.001 | | | | |
| | 12 | 73 | 0.034 | 8 | 0.008 | | | | |
| | 1 | 74 | 0.156 | 6 | 0.012 | | | | |
| | 2 | 74 | 0.108 | 10 | 0.037 | 24 | 0.057 | | |
| | 3 | 74 | 0.093 | 10 | 0.054 | 26 | 0.018 | | |
| | 4 | 74 | 0.071 | 9 | 0.042 | | | | |
| | 5 | 74 | 0.078 | 5 | 0.007 | | | | |
| 1856ZZ | 6 | 73 | 0.053 | 9 | 0.040 | | | | |
| | 7 | 73 | 0.058 | 15 | 0.012 | | | | |
| | 8 | 73 | 0.024 | 12 | 0.007 | | | | |
| | 9 | 73 | 0.011 | 17 | 0.002 | | | | |
| | 10 | 73 | 0.008 | 15 | 0.001 | | | | |
| | 11 | 73 | 0.009 | 11 | 0.001 | | | | |
| | 12 | 73 | 0.020 | 8 | 0.005 | | | | |
| | 1 | 74 | 0.091 | 6 | 0.007 | | | | |
| | 2 | 74 | 0.063 | 10 | 0.021 | 24 | 0.034 | | |
| | 3 | 74 | 0.054 | 10 | 0.031 | 26 | 0.010 | | |
| | 4 | 74 | 0.041 | 9 | 0.025 | | | | |
| | 5 | 74 | 0.046 | 5 | 0.004 | | | | |

# APPENDIX D

## PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 76/03/30

185601
41 43 12.0 084 54 09.0 3
MARSH LAKE
18151 INDIANA

003291

11EPALES 2111202
0038 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00010 WATER TEMP CENT | 00300 DO MG/L | 00077 TRANSP SECCHI INCHES | 00094 CNDUCTVY FIELD MICROMHO | 00400 PH SU | 00410 T ALK CACO3 MG/L | 00610 NH3-N TOTAL MG/L | 00625 TOT KJEL N MG/L | 00630 NO2&NO3 N-TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 73/05/03 | 13 | 50 0000 | 12.7 | | 48 | 625 | 8.40 | 230 | 0.060 | 1.100 | 0.070 | 0.009 |
| | 13 | 50 0006 | 12.7 | 10.0 | | 640 | 8.40 | 238 | 0.080 | 1.100 | 0.070 | 0.016 |
| | 13 | 50 0015 | 12.7 | 9.2 | | 650 | 8.30 | 238 | 0.060 | 1.000 | 0.060 | 0.019 |
| | 13 | 50 0024 | 10.3 | 9.6 | | 650 | 8.20 | 210 | 0.170 | 1.000 | 0.200 | 0.026 |
| | 13 | 50 0034 | 8.7 | 5.2 | | 650 | 8.00 | 250 | 0.620 | 1.400 | 0.310 | 0.194 |
| 73/08/06 | 09 | 30 0000 | 25.4 | 14.2 | 50 | 600 | 8.60 | 258 | 0.080 | 1.500 | 0.070 | 0.019 |
| | 09 | 30 0005 | 24.3 | 18.0 | | 611 | 7.90 | 276 | 0.070 | 1.200 | 0.070 | 0.044 |
| | 09 | 30 0010 | 21.6 | 2.8 | | 600 | 8.20 | 294 | 0.090 | 0.900 | 0.080 | 0.066 |
| | 09 | 30 0015 | 14.7 | 0.0 | | 502 | 7.70 | 270 | 0.330 | 1.000 | 0.070 | 0.191 |
| | 09 | 30 0020 | 12.3 | | | 476 | | | | | | |
| | 09 | 30 0025 | 11.1 | | | 470 | | | | | | |
| | 09 | 30 0030 | 10.4 | | | 470 | | | | | | |
| | 09 | 30 0035 | 10.1 | 0.0 | | 471 | 7.40 | 420 | 3.900 | 5.500 | 0.240 | 1.300 |
| 73/10/15 | 15 | 45 0000 | 16.7 | 9.4 | 48 | 547 | 8.40 | 270 | 0.080 | 1.000 | 0.070 | 0.009 |
| | 15 | 45 0015 | 15.1 | 2.6 | | 557 | 7.90 | 296 | 0.340 | 1.100 | 0.080 | 0.097 |
| | 15 | 45 0020 | 11.7 | 0.0 | | 497 | 7.60 | 305 | 2.280 | 3.200 | 0.110 | 0.688 |
| | 15 | 45 0033 | 8.9 | 0.5 | | 506 | 7.10 | 355 | 7.680 | 10.100 | 0.090 | 0.150 |

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00665 PHOS-TOT MG/L P | 32217 CHLRPHYL A UG/L |
|---|---|---|---|---|
| 73/05/03 | 13 | 50 0000 | 0.045 | 33.4 |
| | 13 | 50 0006 | 0.053 | |
| | 13 | 50 0015 | 0.051 | |
| | 13 | 50 0024 | 0.055 | |
| | 13 | 50 0034 | 0.215 | |
| 73/08/06 | 09 | 30 0000 | 0.078 | 19.4 |
| | 09 | 30 0005 | 0.086 | |
| | 09 | 30 0010 | 0.101 | |
| | 09 | 30 0015 | 0.194 | |
| | 09 | 30 0035 | 1.480 | |
| 73/10/15 | 15 | 45 0000 | 0.053 | 50.6 |
| | 15 | 45 0015 | 0.157 | |
| | 15 | 45 0020 | 0.808 | |
| | 15 | 45 0033 | 0.204 | |

# APPENDIX E

# TRIBUTARY DATA

STORET RETRIEVAL DATE 76/03/30

1856A1
41 43 16.0 084 59 33.0 4
FOLLETTE CREEK
18 7.5 E ANGOLA
O/MARSH LAKE 083291
BANK 300 YDS N END RD 4 MI W OF FREMONT
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 73/06/09 | 15 | 10 | 0.010K | 1.320 | 0.027 | 0.050 | 0.095 |
| 73/07/15 | 10 | 20 | 0.040 | 1.380 | 0.069 | 0.052 | 0.092 |
| 73/08/12 | 09 | 40 | 0.016 | 2.200 | 0.030 | 0.022 | 0.070 |
| 73/09/17 | 09 | 50 | 0.054 | 1.470 | 0.135 | 0.017 | 0.055 |
| 73/10/15 | 14 | 35 | 0.034 | 0.900 | 0.050 | 0.017 | 0.050 |
| 73/11/11 | 09 | 30 | 0.116 | 1.450 | 0.507 | 0.320 | 0.360 |
| 73/12/08 | 11 | 15 | 0.264 | 1.200 | 0.430 | 0.240 | 0.250 |
| 74/01/06 | 10 | 15 | 1.340 | 0.900 | 0.224 | 0.080 | 0.110 |
| 74/02/10 | 10 | 30 | 1.440 | 1.000 | 0.100 | 0.040 | 0.065 |
| 74/02/24 | 10 | 10 | 0.920 | 1.000 | 0.060 | 0.050 | 0.105 |
| 74/03/10 | 10 | 20 | 0.970 | 1.100 | 0.145 | 0.095 | 0.135 |
| 74/03/26 | 09 | 50 | 0.755 | 0.900 | 0.108 | 0.080 | 0.115 |
| 74/04/09 | 10 | 10 | 0.620 | 1.000 | 0.035 | 0.045 | 0.080 |
| 74/05/05 | 14 | 55 | 0.012 | 0.800 | 0.020 | 0.005K | 0.015 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/30

185681
41 43 06.0 084 58 15.0 4
UNNAMED CREEK
18 7.5 E ANGOLA
I/MARSH LAKE 083291
BRDG RUNNING N&S 2 MI W OF FREMONT
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 73/06/09 | 14 30 | | 0.280 | 2.100 | 0.198 | 0.099 | 0.170 |
| 73/07/15 | 09 50 | | 0.340 | 1.980 | 0.320 | 0.099 | 0.170 |
| 73/08/12 | 09 20 | | 0.340 | 1.650 | 0.420 | 0.189 | 0.280 |
| 73/09/17 | 09 00 | | 0.470 | 1.470 | 0.450 | 0.154 | 0.185 |
| 73/10/15 | 14 00 | | 0.350 | 1.550 | 0.370 | 0.190 | 0.300 |
| 73/11/11 | 09 20 | | 0.490 | 1.000 | 0.312 | 0.152 | 0.250 |
| 73/12/08 | 10 50 | | 1.040 | 0.700 | 0.168 | 0.104 | 0.104 |
| 74/01/06 | 09 30 | | 1.600 | 1.200 | 0.312 | 0.064 | 0.085 |
| 74/02/10 | 13 00 | | 6.000 | 1.400 | 0.085 | 0.015 | 0.035 |
| 74/02/24 | 09 30 | | 0.960 | 1.400 | 0.060 | 0.050 | 0.120 |
| 74/03/10 | 09 30 | | 1.440 | 1.500 | 0.025 | 0.070 | 0.125 |
| 74/03/26 | 09 20 | | 0.860 | 1.100 | 0.210 | | |
| 74/04/09 | 09 30 | | 1.090 | 1.400 | 0.040 | 0.065 | 0.105 |
| 74/05/05 | 14 45 | | 0.312 | 1.100 | 0.055 | 0.115 | 0.160 |

STORET RETRIEVAL DATE 76/03/30

1856C1
41 42 28.0 084 42 48.0 4
UNNAMED CREEK
18 7.5 E ANGOLA
T/MARSH LAKE 060191
BRDG RUNNING E & W 3.5 MI W OF FREMONT
11EPALES 2111204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P |
|---|---|---|---|---|---|---|---|
| 73/06/09 | 14 50 | | 0.015 | 0.760 | 0.038 | 0.020 | 0.040 |
| 73/07/15 | 10 00 | | 0.027 | 1.200 | 0.056 | 0.020 | 0.040 |
| 73/08/12 | 09 27 | | 0.010K | 0.840 | 0.056 | 0.022 | 0.040 |
| 73/09/17 | 09 25 | | 0.028 | 1.600 | 0.230 | 0.019 | 0.060 |
| 73/10/15 | 14 20 | | 0.016 | 1.000 | 0.078 | 0.018 | 0.035 |
| 73/11/11 | 09 35 | | 0.032 | 0.550 | 0.068 | 0.016 | |
| 73/12/08 | 11 02 | | 0.060 | 0.600 | 0.084 | 0.010 | 0.012 |
| 74/01/06 | 09 50 | | 0.116 | 0.700 | 0.112 | 0.008 | 0.020 |
| 74/02/10 | 10 15 | | 0.160 | 0.800 | 0.040 | 0.005K | 0.015 |
| 74/02/24 | 09 50 | | 1.360 | 0.600 | 0.085 | 0.015 | 0.015 |
| 74/03/10 | 09 55 | | 0.116 | 0.800 | 0.035 | 0.005 | 0.005 |
| 74/03/26 | 09 10 | | 0.048 | 0.500 | 0.030 | 0.005 | 0.015 |
| 74/04/09 | 09 50 | | 0.012 | 0.600 | 0.020 | 0.010 | 0.015 |
| 74/05/05 | 14 35 | | 0.008 | 1.100 | 0.025 | 0.005 | 0.015 |

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 76/03/30

1856XA TF1856XA P001043
41 42 30.0 084 58 00.0 4
FREMONT
18 7.5 ANGOLA E
T/MARSH LAKE 083291
NO NAME SWAMP
11EPALES 2141204
0000 FEET DEPTH CLASS 00

| DATE FROM TO | TIME OF DAY | DEPTH FEET | 00630 NO2&NO3 N-TOTAL MG/L | 00625 TOT KJEL N MG/L | 00610 NH3-N TOTAL MG/L | 00671 PHOS-DIS ORTHO MG/L P | 00665 PHOS-TOT MG/L P | 50051 FLOW RATE INST MGD | 50053 CONDUIT FLOW-MGD MONTHLY |
|---|---|---|---|---|---|---|---|---|---|
| 73/06/14 | 07 30 | | 1.500 | 15.000 | 8.700 | | 5.700 | 0.089 | 0.145 |
| 73/07/13 | 12 10 | | 4.400 | 16.800 | 5.900 | 3.570 | 4.200 | 0.126 | 0.140 |
| 73/08/14 | 12 37 | | 0.920 | 28.000 | 7.500 | 3.000 | 7.100 | 0.046 | 0.167 |
| 73/09/14 | 12 15 | | 4.000 | 17.000 | 8.100 | 2.100 | 6.350 | 0.098 | 0.125 |
| 73/10/15 | 12 40 | | 2.600 | 25.000 | 9.750 | 1.750 | 7.600 | 0.125 | 0.173 |
| 73/11/14 | 09 40 | | 2.200 | 19.500 | 8.000 | 3.050 | 6.500 | 0.106 | 0.146 |
| 73/12/14 | 08 30 | | 3.100 | 15.000 | 7.700 | 1.320 | 2.900 | 0.143 | 0.120 |
| 74/01/14 | 13 00 | | 1.520 | 24.000 | 15.600 | 4.100 | 6.300 | 0.110 | 0.143 |
| 74/02/13 | 08 30 | | 0.920 | 17.000 | 9.600 | 3.600 | 5.000 | 0.113 | 0.146 |
| 74/03/13 | 12 50 | | 0.400 | 26.000 | | | 6.600 | 0.112 | 0.126 |
| 74/04/15 | 08 30 | | 0.440 | 17.000 | 10.500 | 3.000 | 6.100 | | |
| 74/05/14 | 08 35 | | 0.520 | 24.000 | 9.900 | 4.200 | 5.900 | | |
| 74/06/14 | 08 10 | | 2.240 | 16.000 | 8.000 | 3.750 | 4.300 | | |